FORM 2
THE PATENTS ACT 1970
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COMPLETE SPECIFICATION
(See section 10 and rule 13)

1. TITLE OF THE INVENTION

A LOCKING UNIT FOR A DOCKING RING

2. APPLICANT:

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b) Nationality : IN

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification particularly describes the invention and the manner in which it is to be performed.

TECHNICAL FIELD

The present disclosure relates to space docking rings. More particularly, the present disclosure relates to a locking unit for a docking ring.

BACKGROUND

Generally, capture docking mechanisms are employed to perform the docking of two independent space modules such as spacecrafts or satellites in orbit. The docking is performed to join the space modules for servicing, to form a large habitable platform, or when a laboratory requires clamping of the two mating space modules. Existing docking mechanisms include a plurality of latches adapted to be deflected to receive another docking ring approaching the docking ring having the existing capture mechanism.

Such latches are spring-loaded and passive devices that utilize the approach velocities of another docking ring. Thus, the implementation of the existing capture mechanisms is limited to the large inertia-based docking rings having higher approach velocities. Therefore, the existing capture mechanism cannot grapple with another docking ring with zero relative approach velocity. Further, the latches of the existing capture mechanism are independently operated by using individual actuators and motors, and a de-capturing operation of the docking rings is also motorized. This increases overall power consumption, and cost associated with the docking ring.

Therefore, in view of the above-mentioned problems, it is desirable to provide a locking unit that can eliminate one or more above-mentioned problems associated with existing art.

SUMMARY

This summary is provided to introduce a selection of concepts, in a simplified format, that are further described in the detailed description of the invention. This summary is neither intended to identify key or essential inventive concepts of the invention nor intended to determine the scope of the invention.

In an embodiment, the present disclosure relates to a locking unit for a docking ring. The locking unit may include a hinge bracket, a first shaft, a first locking arm, and an actuation mechanism. The hinge bracket may be mounted on the docking ring. The first shaft may be positioned in the hinge bracket and has a drive pulley mounted thereon. The first locking arm may be mounted on the first shaft adjacent to the drive pulley and may be adapted to toggle between an unlocked position and a locked position based on a rotation of the first shaft, to engage with a docking panel. The actuation mechanism may be coupled with the hinge bracket. The actuation mechanism may include a wrap pulley, a motor, and a lock disc. The wrap pulley may be adapted to form a pulley drive with the drive pulley of the first shaft. The motor may be coupled to an end of the wrap pulley and may be adapted to rotate the wrap pulley to swing the first locking arm from the unlocking position and the locking position. The lock disc may be adapted to selectively engage/disengage to the wrap pulley to prevent/allow rotation of the wrap pulley and toggle the first locking arm between the locking position and the unlocking position.

In another embodiment, the present disclosure relates to a docking ring. The docking ring may include a plurality of petals and a locking unit. The plurality of petals may be positioned on a periphery of the docking ring. The first locking unit may be positioned on the periphery of the docking ring, adjacent to the plurality of petals. The locking unit may include a hinge bracket, a first shaft, a first locking arm, and an actuation mechanism. The hinge bracket may be mounted on the docking ring. The first shaft may be positioned in the hinge bracket and has a drive

pulley mounted thereon. The first locking arm may be mounted on the first shaft adjacent to the drive pulley and may be adapted to toggle between an unlocked position and a locked position based on a rotation of the first shaft, to engage with a docking panel. The actuation mechanism may be coupled with the hinge bracket. The actuation mechanism may include a wrap pulley, a motor, and a lock disc. The wrap pulley may be adapted to form a pulley drive with the drive pulley of the first shaft. The motor may be coupled to an end of the wrap pulley and may be adapted to rotate the wrap pulley to swing the first locking arm from the unlocking position and the locking position. The lock disc may be adapted to selectively engage/disengage the wrap pulley to prevent/allow rotation of the wrap pulley to toggle the first locking arm between the locking position and the unlocking position.

In the present disclosure, the locking unit of the docking ring may be used for large as well as low inertia-based spacecraft as the locking unit is capable of grabbing a docking panel with zero relative approach velocity. Further, the single locking unit may operate the other locking units of the docking unit through a tensioned cable to control the movement of the locking arms for grappling the docking panel. The locking unit is mass and power-optimized. Moreover, the locking unit is non-consumable and may be used repetitively for multiple docking attempts.

To further clarify the advantages and features of the present disclosure, a more particular description of the invention will be rendered by reference to specific embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present disclosure will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

Figure 1(a) illustrates a perspective view of a docking ring aligning with a docking panel to be captured, according to an embodiment of the present disclosure;

Figure 1(b) illustrates a perspective view of the docking ring receiving the docking panel, according to an embodiment of the present disclosure;

Figure 1(c) illustrates a perspective view of the docking ring completely with the docking panel, according to an embodiment of the present disclosure;

Figure 2(a) illustrates a top view of the docking ring, according to an embodiment of the present disclosure;

Figure 2(b) illustrates a bottom view of the docking ring, according to an embodiment of the present disclosure;

Figure 2(c) illustrates a view of the docking ring without petals, according to an embodiment of the present disclosure;

Figure 2(d) illustrates a section view of the docking ring, according to an embodiment of the present disclosure;

Figure 3 illustrates a perspective view of a locking unit of the docking ring, according to an embodiment of the present disclosure;

Figure 4(a) illustrates a perspective view of an actuation mechanism of the locking unit in a locked position, according to an embodiment of the present disclosure;

Figure 4(b) illustrates a perspective view of the actuation mechanism of the locking unit in an unlocked position, according to an embodiment of the present disclosure;

Figure 5(a) illustrates a rear view of a lock disc of the actuation mechanism, according to an embodiment of the present disclosure;

Figure 5(b) illustrates a front view of the lock disc of the actuation mechanism, according to an embodiment of the present disclosure; and

Figure 6 illustrates a perspective view of a motor shaft, a first disc, and a second disc of the actuation mechanism, according to an embodiment of the present disclosure.

Further, skilled artisans will appreciate that elements in the drawings are illustrated for simplicity and may not have necessarily been drawn to scale. For example. Furthermore, in terms of the construction of the device, one or more components of the device may have been represented in the drawings by conventional symbols, and the drawings may show only those specific details that are pertinent to understanding the embodiments of the present invention so as not to obscure the drawings with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

DETAILED DESCRIPTION OF FIGURES

For the purpose of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated system, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skilled in the art to which this invention belongs. The system, methods, and examples provided herein are illustrative only and not intended to be limiting.

The term “some” as used herein is defined as “none, or one, or more than one, or all.” Accordingly, the terms “none,” “one,” “more than one,” “more than one, but not all” or “all” would all fall under the definition of “some.” The term “some embodiments” may refer to no embodiments or to one embodiment or to

several embodiments or to all embodiments. Accordingly, the term "some embodiments" is defined as meaning "no embodiment, or one embodiment, or more than one embodiment, or all embodiments."

The terminology and structure employed herein are for describing, teaching and illuminating some embodiments and their specific features and elements and do not limit, restrict or reduce the spirit and scope of the claims or their equivalents.

More specifically, any terms used herein such as but not limited to "includes," "comprises," "has," "consists," and grammatical variants thereof do NOT specify an exact limitation or restriction and certainly do NOT exclude the possible addition of one or more features or elements, unless otherwise stated, and furthermore must NOT be taken to exclude the possible removal of one or more of the listed features and elements, unless otherwise stated with the limiting language "MUST comprise" or "NEEDS TO include."

Whether or not a certain feature or element was limited to being used only once, either way, it may still be referred to as "one or more features" "one or more elements" "at least one feature" or "at least one element." Furthermore, the use of the terms "one or more" or "at least one" feature or element does NOT preclude there being none of that feature or element, unless otherwise specified by limiting language such as "there NEEDS to be one or more . . . " or "one or more element is REQUIRED."

Unless otherwise defined, all terms, and especially any technical and/or scientific terms, used herein may be taken to have the same meaning as commonly understood by one having an ordinary skill in the art.

Reference is made herein to some "embodiments." It should be understood that an embodiment is an example of a possible implementation of any features and/or elements presented in the attached claims. Some embodiments have been

described for the purpose of illuminating one or more of the potential ways in which the specific features and/or elements of the attached claims fulfil the requirements of uniqueness, utility, and non-obviousness.

Use of the phrases and/or terms such as but not limited to "a first embodiment," "a further embodiment," "an alternate embodiment," "one embodiment," "an embodiment," "multiple embodiments," "some embodiments," "other embodiments," "a further embodiment", "furthermore embodiment", "additional embodiment" or variants thereof do NOT necessarily refer to the same embodiments. Unless otherwise specified, one or more particular features and/or elements described in connection with one or more embodiments may be found in one embodiment or may be found in more than one embodiment, or may be found in all embodiments, or may be found in no embodiments. Although one or more features and/or elements may be described herein in the context of only a single embodiment, or alternatively in the context of more than one embodiment, or further alternatively in the context of all embodiments, the features and/or elements may instead be provided separately or in any appropriate combination or not at all. Conversely, any feature and/or element described in the context of separate embodiments may alternatively be realized as existing together in the context of a single embodiment.

Any particular and all details set forth herein are used in the context of some embodiments and therefore should NOT be necessarily taken as limiting factors to the attached claims. The attached claims and their legal equivalents can be realized in the context of embodiments other than the ones used as illustrative examples in the description below.

Embodiments of the present disclosure will be described below in detail with reference to the accompanying drawings.

Further, skilled artisans will appreciate those elements in the drawings are illustrated for simplicity and may not have necessarily been drawn to scale. For example, the flow charts illustrate the method in terms of the most prominent steps involved to help to improve understanding of aspects of the present disclosure. Furthermore, in terms of the construction of the device, one or more components of the device may have been represented in the drawings by conventional symbols, and the drawings may show only those specific details that are pertinent to understanding the embodiments of the present disclosure so as not to obscure the drawings with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

Figure 1(a) illustrates a perspective view of a docking ring 100 aligning with a docking panel 200 to be captured, according to an embodiment of the present disclosure while **Figure 1(b)** illustrates a perspective view of the docking ring 100 receiving the docking panel 200, according to an embodiment of the present disclosure. Further, **Figure 1(c)** illustrates a perspective view of the docking ring 100 completely with the docking panel 200, according to an embodiment of the present disclosure. The docking ring 100 is adapted to receive the docking panel 200 of the space module such as a spacecraft or a satellite, approaching towards the docking ring 100. Herein, the docking panel 200 may be docked with the docking ring 100 to service the docking panel 200 or make a large habitable platform. Further, the docking of two mating space modules is also performed based on a requirement of a laboratory. In an embodiment, the docking panel 200 may be embodied as another docking ring.

The docking ring 100 may include a plurality of petals 101, and a plurality of locking units namely a first locking unit 102A, and a plurality of second locking units 102B. The plurality of petals 101 may be positioned on a periphery of the docking ring 100. The plurality of second locking units 102B is positioned on the periphery of the docking ring 100 adjacent to the first locking unit 102A. The first locking unit 102A may include an actuation mechanism 112 adapted to drive the

plurality of second locking units 102B to execute the docking of the docking ring 100 and the docking panel 200. According to the present disclosure, a single actuation mechanism may operate all the locking units 102A, 102B. Further, the docking panel 200 may include, but is not limited to, a plurality of petals 101' positioned on a periphery of the docking panel 200.

Initially, the locking units 102A, 102B of the docking ring 100 align with the plurality of petals 101' of the docking panel 200 approaching the docking ring 100, as shown in **Figure 1(a)**. Further, the actuation mechanism 112 activates the first locking unit 102A and the plurality of second locking units 102B to receive the docking panel 200, and the docking of the docking ring 100 and the docking panel 200, as shown in **Figure 1(b)**. Furthermore, the docking ring 100 completely captures the docking panel 200 when the first locking unit 102A completely engages with the plurality of petals 101' of the docking panel 200, as shown in **Figure 1(c).** The operational and functional details of the docking ring 100 are explained in subsequent paragraphs.

Figure 2(a) illustrates a top view of the docking ring 100, according to an embodiment of the present disclosure while **Figure 2(b)** illustrates a bottom view of the docking ring 100, according to an embodiment of the present disclosure. Further, **Figure 2(c)** illustrates a view without petals of the docking ring 100, according to an embodiment of the present disclosure while **Figure 2(d)** illustrates a sectional view of the docking ring 100, according to an embodiment of the present disclosure. Referring to **Figures 2(a) 2(b)** and **2(c)**, the docking ring 100 may include the locking unit 102A, the plurality of second locking units 102B, and the plurality of petals 101. The first locking unit 102A may be positioned on the periphery of the docking ring 100, adjacent to the plurality of petals 101. The plurality of second locking units 102B may be positioned on the periphery of the docking ring 100 adjacent to the locking unit 102A.

The docking ring 100 defines a peripheral surface to accommodate the first locking unit 102A, the plurality of second locking units 102B, and the plurality of petals 101. The construction of the plurality of second locking units 102B is the same as the construction of the first locking unit 102A except the plurality of second locking units 102B does not include the actuation mechanism 112. Herein, the first locking unit 102A is equipped with the actuation mechanism 112. The actuation mechanism 112 may be connected with the first locking unit 102A, and the plurality of second locking units 102B via a cable 126, such that the actuation mechanism 112 may operate the first locking unit 102A, and the plurality of second locking units 102B. This saves the power consumption in driving the first locking unit 102A, the plurality of second locking units 102B and makes the docking ring 100 power optimized.

The locking unit 102A may include a first proximity sensor 134 and a second proximity sensor 136, as shown in Figure 2(a). The first proximity sensor 134 may be in communication with an actuator 138 of the actuation mechanism 112 and may be adapted to detect the docking panel 200 and generate a first entry signal wherein no action is taken. When the second proximity sensor 136 position below the first proximity sensor 134 at a predefined position with respect to the first proximity sensor 134, also detects the docking panel 200, immediately the signal is generated to actuate the disengagement of a lock disc 116 from a drive disc 120 and actuate the wrap pulley 114 to rotate the first locking arm 110 from the unlocked position to locked position.

In the subsequent paragraphs, the first locking unit 102A may be interchangeably referred to as the locking unit 102A, without departing from the scope of the present disclosure.

Figure 3 illustrates a perspective view of the locking unit 102A of the docking ring 100, according to an embodiment of the present disclosure. Referring to **Figures 2(a)** and **3**, the locking unit 102A may include a hinge bracket 104, a

first shaft 106, the first locking arm 110, and an actuation mechanism 112. The hinge bracket 104 may be mounted on the docking ring 100. The hinge bracket 104 may be attached to the actuation mechanism 112. The hinge bracket 104 defines a hollow portion to accommodate the first shaft 106, the first locking arm 110, the drive pulley 108, and a guide pulley 109. The guide pulley 109 is positioned in proximity to a routing pulley 111 adapted to route the cable 126.

The first shaft 106 may be positioned in the hinge bracket 104 and has a drive pulley 108 mounted thereon. The first locking arm 110 may be mounted on the first shaft 106 adjacent to the drive pulley 108 and may be adapted to toggle between an unlocked position and a locked position based on a rotation of the first shaft 106, to engage with a docking panel 200. Further, a torsion spring 118 may be positioned on both ends of the first shaft 106. The torsion spring 118 may be adapted to swing the first locking arm 110 from the locking position and the unlocking position. The locking unit 102A may include a first contact sensor 142 and a second contact sensor 144 positioned in the hinge bracket 104. The first contact sensor 142 may be adapted to detect the locking position of the first locking arm 110. Further, the second contact sensor 144 may be adapted to detect the unlocking position of the first locking arm 110.

The actuation mechanism 112 may be coupled with the hinge bracket 104. The actuation mechanism 112 may include a wrap pulley 114, a motor, the lock disc 116, an actuator 138, and the drive disc 120. The wrap pulley 114 may be adapted to form a pulley drive with the drive pulley 108 of the first shaft 106. The motor may be coupled to an end of the wrap pulley 114 to rotate the wrap pulley 114 to swing the first locking arm 110 from the locking position to the unlocking position. The pulley drive may be a cross-pulley drive. The pulley drive may include the cable 126 to drive the drive pulley 108 upon the rotation of the wrap pulley 114 to move the first locking arm 110 from the unlocking position to the locking position.

The lock disc 116 may be adapted to selectively engage to or disengage from the wrap pulley 114 to prevent or allow rotation of the wrap pulley 114 and toggle the first locking arm 110 between the locking position and the unlocking position. The drive disc 120 may be coupled with the wrap pulley 114 and adapted to be selectively engaged with the lock disc 116. The actuator 138 may be coupled with the lock disc 116. The actuator 138 may include a plunger 140 adapted to be retracted, based on an input received from the first proximity sensor 134 and the second proximity sensor 136, to disengage the lock disc 116 from the drive disc 120 to allow the rotation of the wrap pulley 114. In an embodiment, the actuator 138 may embodied as a solenoid actuator 138.

Figure 4(a) illustrates a perspective view of an actuation mechanism 112 of the locking unit 102A in a locked position, according to an embodiment of the present disclosure while **Figure 4(b)** illustrates a perspective view of the actuation mechanism 112 of the locking unit 102A in an unlocked position, according to an embodiment of the present disclosure. The lock disc 116 engages with the drive disc 120 coupled to the wrap pulley 114 to prevent rotation of the wrap pulley 114 and toggle the first locking arm 110 between the locking position and the unlocking position, as shown in **Figure 4(a)**. Herein, the transmission of the motion from the motor to the first locking arm 110, through the wrap pulley 114, is restricted, such that the toggling of the first locking arm 110 is prevented. On the other hand, the lock disc 116 disengages from the drive disc 120 coupled to the wrap pulley 114, to allow rotation of the wrap pulley 114 when the actuator 138 is activated to retract the plunger 140. The rotation of the wrap pulley 114 further moves the first locking arm 110 between the locking position and the unlocking position.

Figure 5(a) illustrates a rear view of a lock disc 116 of the actuation mechanism 112, according to an embodiment of the present disclosure while **Figure 5(b)** illustrates a front view of the lock disc 116 of the actuation mechanism 112, according to an embodiment of the present disclosure. Referring to Figures 5(a) and 5(b), the drive disc 120 may include a plurality of holes 122. In the

illustrated embodiment, the drive disc 120 may include two holes 122. In another embodiment, the drive disc 120 may include more than two holes 122. The lock disc 116 may include a plurality of protrusions 124 adapted to be engaged in the plurality of holes 122 to restrict the rotation of the drive disc 120 and the wrap pulley 114. In the illustrated embodiment, the lock disc 116 may include two protrusions 124. In another embodiment, the lock disc 116 may include more than two protrusions 124. The lock disc 116 may include a third contact sensor adapted to detect the engagement of the lock disc 116 and the drive disc 120.

Figure 6 illustrates a perspective view of a motor shaft 128, a first disc 130 a second disc 132 of the actuation mechanism 112, according to an embodiment of the present disclosure. Referring to **Figures 4(a), 4(b)**, and **6**, the actuation mechanism 112 may include the motor shaft 128, the first disc 130, and the second disc 132. The motor shaft 128 may be adapted to transmit the motion from the motor to the wrap pulley 114. The first disc 130 may be mounted on the motor shaft 128 and may include a plurality of pins 133. The second disc 132 may be mounted on the motor shaft 128 and may include a plurality of slots 135 adapted to receive the plurality of pins 133. The engagement of the plurality of pins 133 in the plurality of slots 135 restricts a back driving of the motor. During locking first disc 130 rotates in the slot provided in the second disc 132 without back driving the motor. During unlocking, the second disc 132 rotates along with the motor and transfers the motion to the first disc 130 through the plural number of pins 133. This in-turn transfers the motion to the wrap pulley 114 and also drive disc 120. The motion continues till the lock disc 116 with plural number of protrusions 124 automatically engages with the plural number of holes 122 due to the push force of the actuator 138.

Referring to **Figures 1(c) and 2(a)**, each of the plurality of second locking units 102B may include a hinge bracket 104, a second shaft 106', and a second locking arm 110'. The hinge bracket 104 may be mounted on the periphery of the docking ring 100. The second shaft 106' may be positioned in the hinge bracket 104 and has a drive pulley 108 mounted thereon. The second locking arm 110' may

be mounted on the first shaft 106 adjacent to the drive pulley 108 and adapted to toggle between the unlocking position and the locking position. The wrap pulley 114 of the first locking unit 102A forms a pulley drive with the drive pulley 108 of each second locking unit 102A' to synchronize the motion of the second locking arm 110' of each second locking unit 102A'.

Locking unit 102A, according to the present disclosure, the actuation mechanism 112 can operate the first locking unit 102A and the plurality of second locking units 102B to move the first locking arm 110 and the second locking arm 110' between the locking position and the unlocking position in synchrony. therefore, no separate actuation mechanism 112 is required for the individual locking units 102A, 102B. Such a configuration saves the overall cost and the weight of the docking ring 100 having such locking unit 102A. Further, the locking unit 102A is mass and power-optimized as the single actuation mechanism 112 may operate all the locking units 102A, 102B through the tensioned cable 126 to control the movement of the locking arms 110, 110' for grappling the docking panel 200. Therefore, the locking unit 102A of the docking ring 100 may be used for large as well as low inertia-based spacecraft as the locking unit 102A is capable of grabbing the docking panel 200 with zero relative approach velocity. Moreover, the locking unit 102A is non-consumable and may be used repetitively for multiple docking attempts.

While specific language has been used to describe the present subject matter, any limitations arising on account thereto, are not intended. As would be apparent to a person in the art, various working modifications may be made to the method in order to implement the inventive concept as taught herein. The drawings and the foregoing description give examples of embodiments. Those skilled in the art will appreciate that one or more of the described elements may well be combined into a single functional element. Alternatively, certain elements may be split into multiple functional elements. Elements from one embodiment may be added to another embodiment.

We Claim:

1. A locking unit (102A) for a docking ring (100), the locking unit (102A) comprising:

a hinge bracket (104) mounted on the docking ring (100);

a first shaft (106) positioned in the hinge bracket (104) and having a drive pulley (108) mounted thereon;

a first locking arm (110) mounted on the first shaft (106) adjacent to the drive pulley (108) and adapted to toggle between an unlocked position and a locked position based on a rotation of the first shaft (106), to engage with a docking panel (200);

an actuation mechanism (112) coupled with the hinge bracket (104), comprising:

a wrap pulley (114) adapted to form a pulley drive with the drive pulley (108) of the first shaft (106);

a motor coupled to an end of the wrap pulley (114) and adapted to rotate the wrap pulley (114) to swing the first locking arm (110) from the locking position to the unlocking position; and

a lock disc (116) adapted to selectively engage/disengage to the wrap pulley (114) to prevent/allow rotation of the wrap pulley (114) and toggle the first locking arm (110) between the locking position and the unlocking position.

2. The locking unit (102A) as claimed in claim 1, comprising a torsion spring (118) positioned on an end of the first shaft (106) and adapted to swing the first locking arm (110) from the locking position and the unlocking position.

3. The locking unit (102A) as claimed in claim 1, wherein the actuation mechanism (112) comprises a drive disc (120) coupled with the wrap pulley (114) and adapted to be selectively engaged with the lock disc (116).

4. The locking unit (102A) as claimed in claim 3, wherein the drive disc (120) comprises a plurality of holes (122) and the lock disc (116) comprises a plurality of protrusions (124) adapted to be engaged in the plurality of holes (122) to restrict the rotation of the drive disc (120) and the wrap pulley (114).

5. The locking unit (102A) as claimed in claim 1, wherein the pulley drive is a cross-pulley drive and comprises a cable (126), such that the cable (126) drives the drive pulley (108) upon the rotation of the wrap pulley (114) to move the first locking arm (110) from the locking position and the unlocking position.

6. The locking unit (102A) as claimed in claim 1, wherein the actuation mechanism (112) comprises:

a motor shaft (128) adapted to transmit the motion from the motor to the wrap pulley (114);

a first disc (130) mounted on the motor shaft (128) and comprises a plurality of pins (133); and

a second disc (132) mounted on the motor shaft (128) and comprises a plurality of slots (135) adapted to receive the plurality of pins (133),

wherein the engagement of the plurality of pins (133) in the plurality of slots (135) restricts a back driving of the motor.

7. The locking unit (102A) as claimed in claim 1, comprising:

a first proximity sensor (134) in communication with an actuator (138) of the actuation mechanism (112) and adapted to detect the docking panel (200) and generate a first signal for indicating the presence of docking panel; and

a second proximity sensor (136) in communication with the actuator (138) and positioned below the first proximity sensor (134) at a predefined space to detect the docking panel (200) and generate a second signal to

actuate the engage the lock disc (116) with the drive disc (120) through the actuator (138) to rotate the first locking arm (110) from the unlocked position to locked position.

8. The locking unit (102A) as claimed in claims 3 or 7, wherein the actuator (138) is a solenoid actuator (138) coupled with the lock disc (116) and comprises a plunger (140) adapted to be retracted, based on an input received from the first proximity sensor (134) and the second proximity sensor (136), to disengage the lock disc (116) from the drive disc (120) to allow the rotation of the wrap pulley (114).

9. A docking ring (100), comprising:

a plurality of petals (101) positioned on a periphery of the docking ring (100);

a first locking unit (102A) positioned on the periphery of the docking ring (100), adjacent to the plurality of petals (101), the first locking unit (102A) comprising:

a hinge bracket (104) mounted on the docking ring (100);

a first shaft (106) positioned in the hinge bracket (104) and having a drive pulley (108) mounted thereon;

a first locking arm (110) mounted on the first shaft (106) adjacent to the drive pulley (108) and adapted to toggle between an unlocked position and a locked position based on a rotation of the first shaft (106), to engage with a docking panel (200);

an actuation mechanism (112) coupled with the hinge bracket (104), comprising:

a wrap pulley (114) adapted to form a pulley drive with the drive pulley (108) of the first shaft (106);

a motor coupled to an end of the wrap pulley (114) and adapted to rotate the wrap pulley (114) to swing the first

locking arm (110) from the unlocking position and the locking position; and

a lock disc (116) to selectively engage/disengage to the wrap pulley (114) to prevent/allow rotation of the wrap pulley (114) toggle the first locking arm (110) between the locking position and the unlocking position.

10. The docking ring (100) as claimed in claim 9, comprising a plurality of second locking units (102B) positioned on the periphery of the docking ring (100) adjacent to the first locking unit (102A), each of the plurality of second locking units (102B) comprises:

a hinge bracket (104) mounted on the periphery of the docking ring (100);

a second shaft (106') positioned in the hinge bracket (104) and having a drive pulley (108') mounted thereon; and

a second locking arm (110') mounted on the first shaft (106) adjacent to the drive pulley (108) and adapted to toggle between the unlocking position and the locking position,

wherein the wrap pulley (114) of the first locking unit (102A) forms a pulley drive with the drive pulley (108) of each second locking unit (102A) to synchronize motion of the second locking arm (110') of each second locking unit (102A).

Dated this **04th** day of **December, 2023**

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ABSTRACT OF THE INVENTION

A LOCKING UNIT FOR A DOCKING RING

The present disclosure relates to a locking unit (102A) for a docking ring (100). The locking unit (102A) may include a hinge bracket (104), a first shaft (106), a first locking arm (110), and an actuation mechanism (112). The hinge bracket (104) may be mounted on the docking ring (100). The first shaft (106) may be positioned in the hinge bracket (104) and has a drive pulley (108) mounted thereon. The first locking arm (110) may be mounted on the first shaft (106) adjacent to the drive pulley (108) and may be adapted to toggle between an unlocked position and a locked position based on a rotation of the first shaft (106), to engage with a docking panel (200). The actuation mechanism (112) may be coupled with the hinge bracket (104). The actuation mechanism (112) may include a wrap pulley (114), a motor, and a lock disc (116).

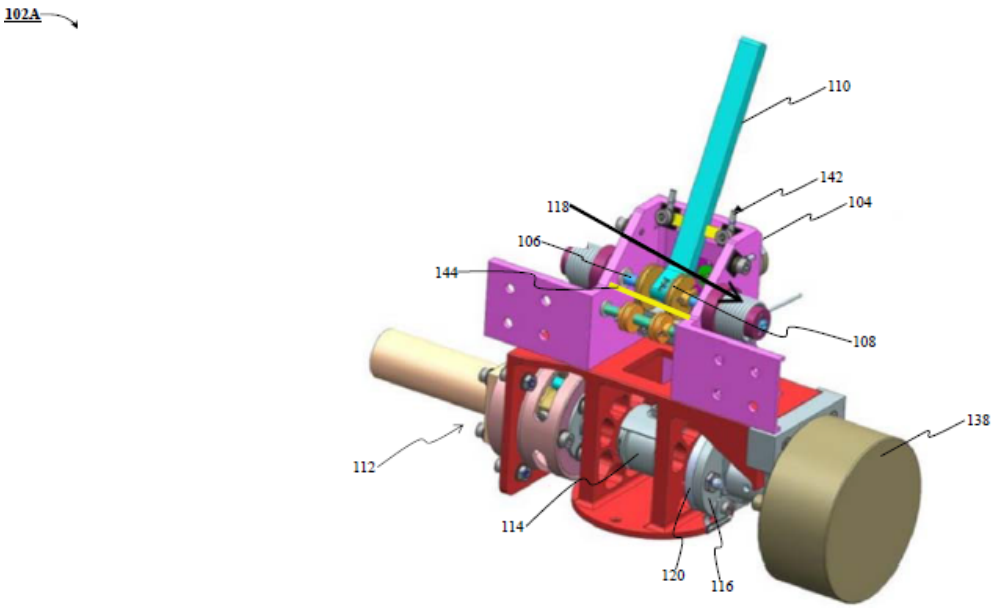

FIGURE 3

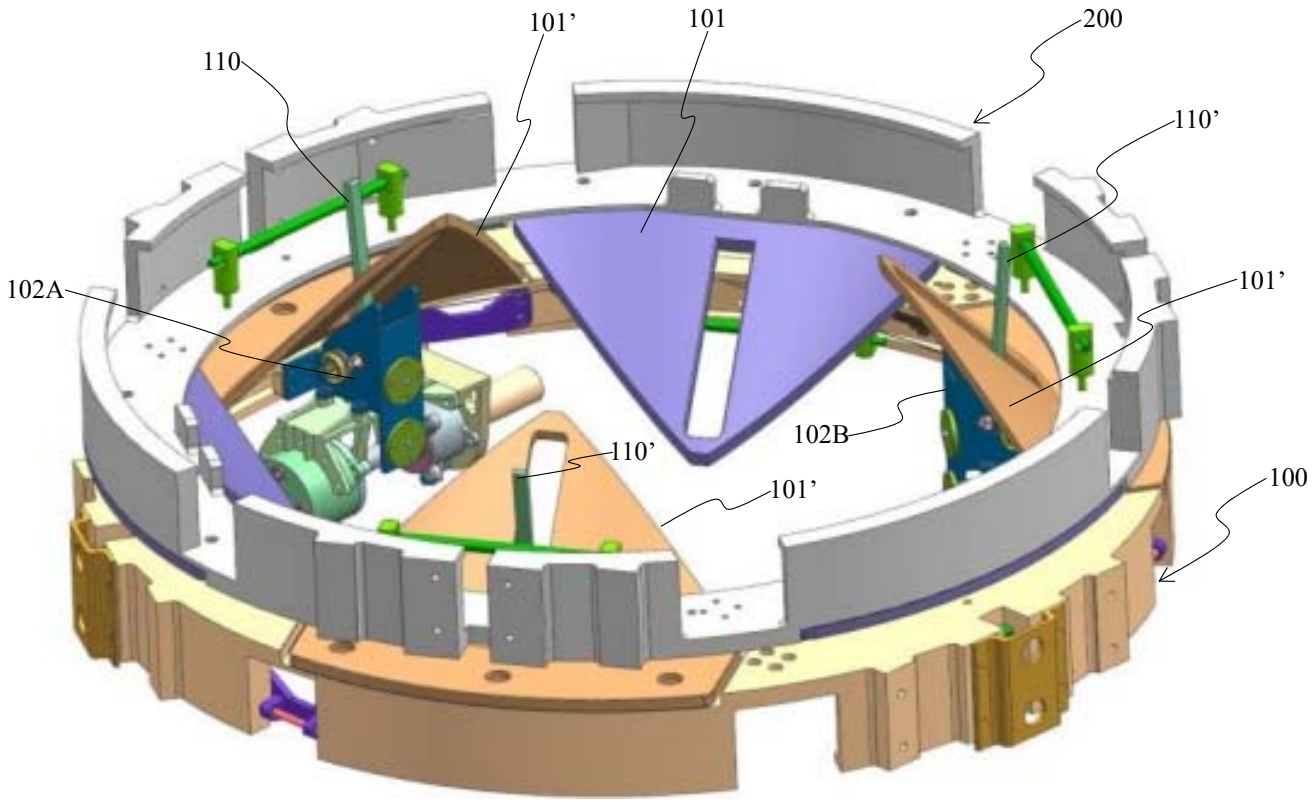

FIGURE 1(a)

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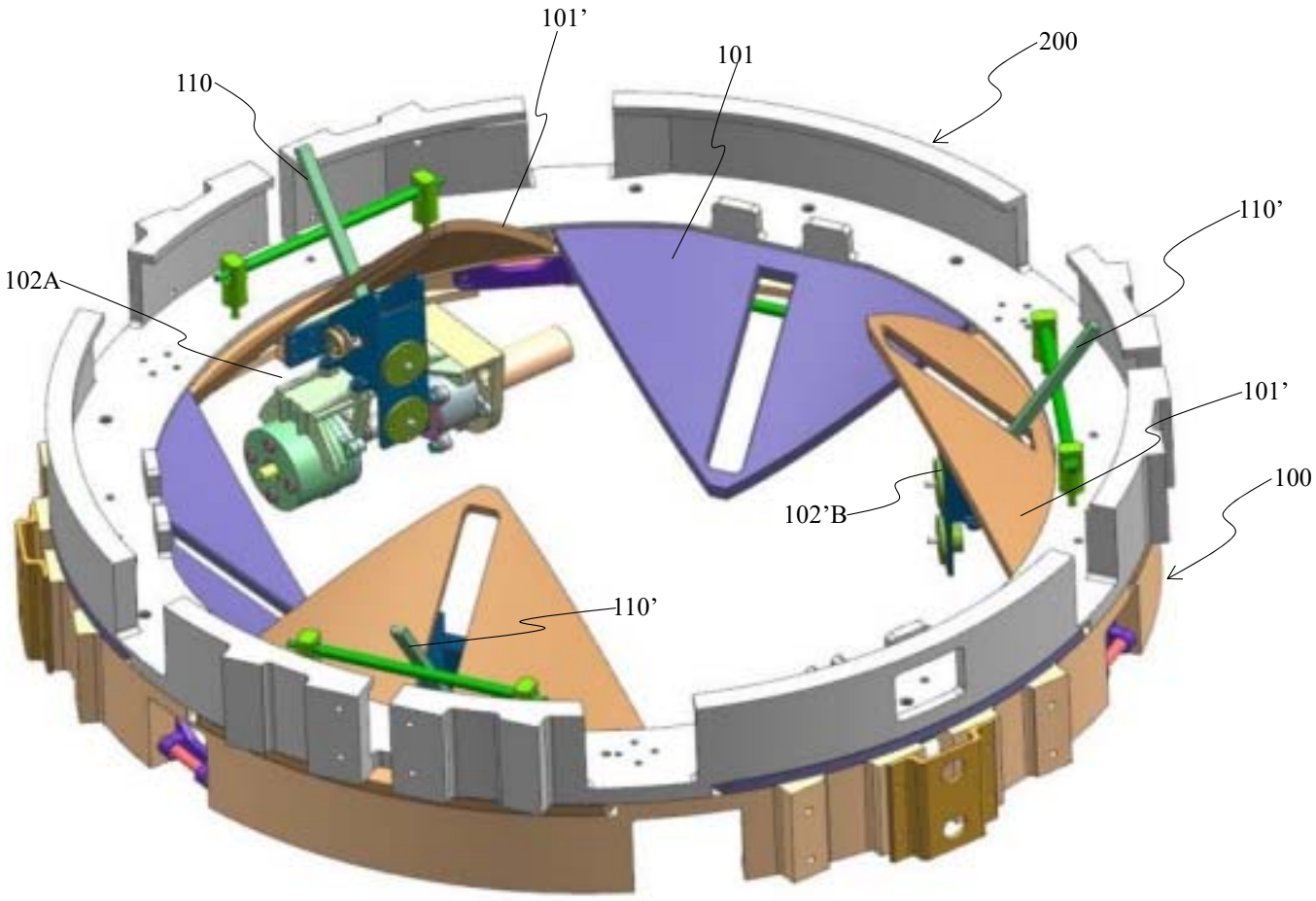

FIGURE 1(b)

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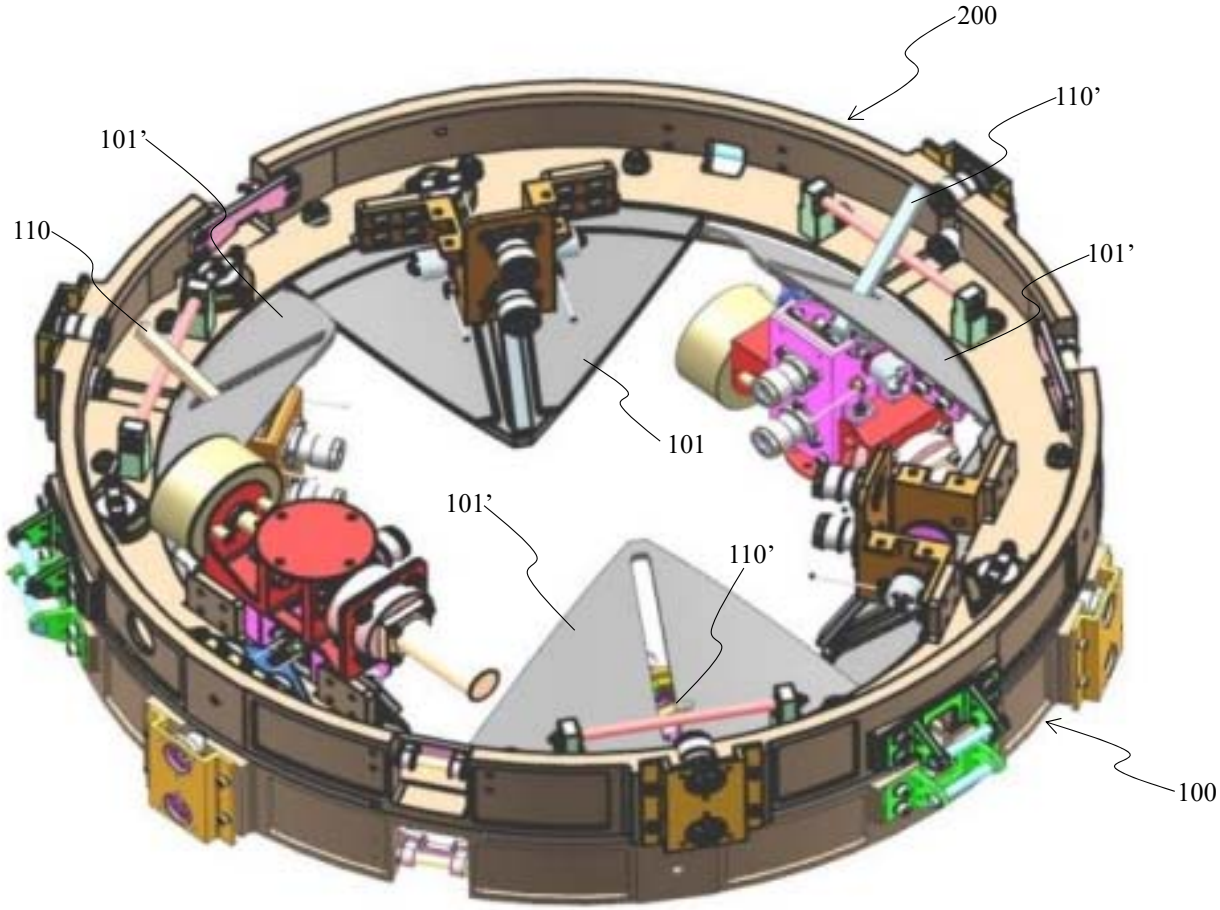

FIGURE 1(c)

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100

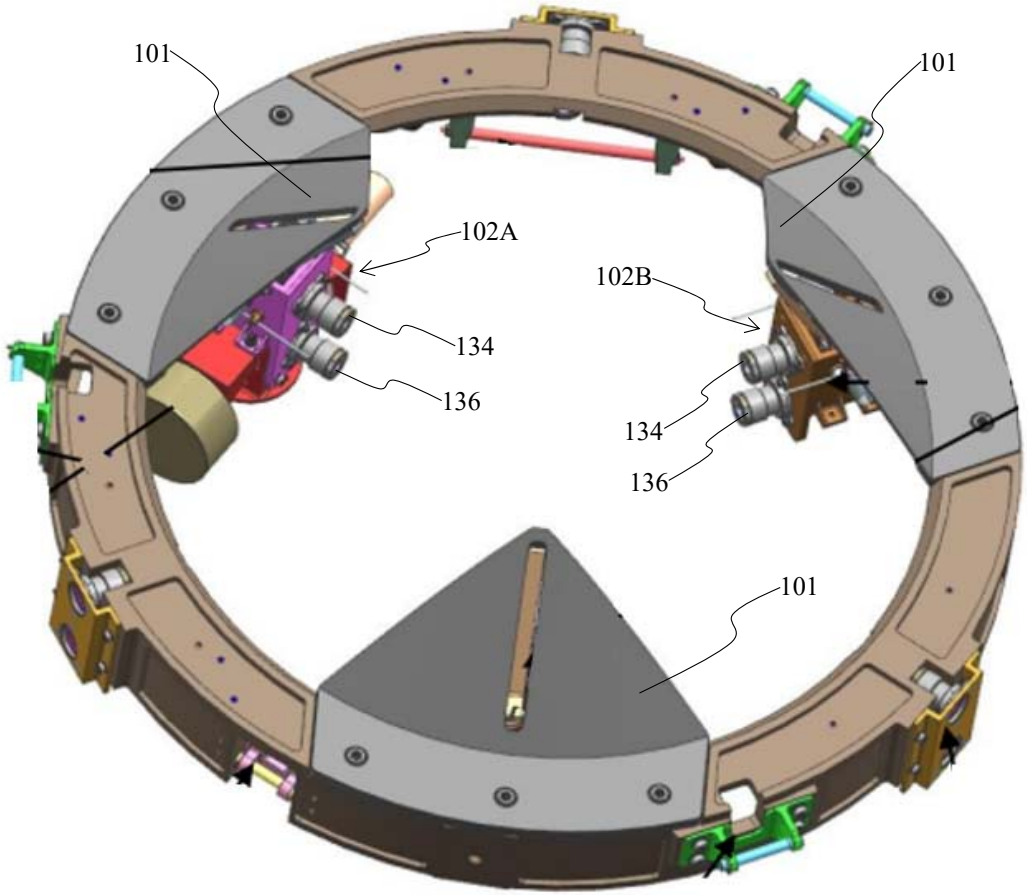

FIGURE 2(a)

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100

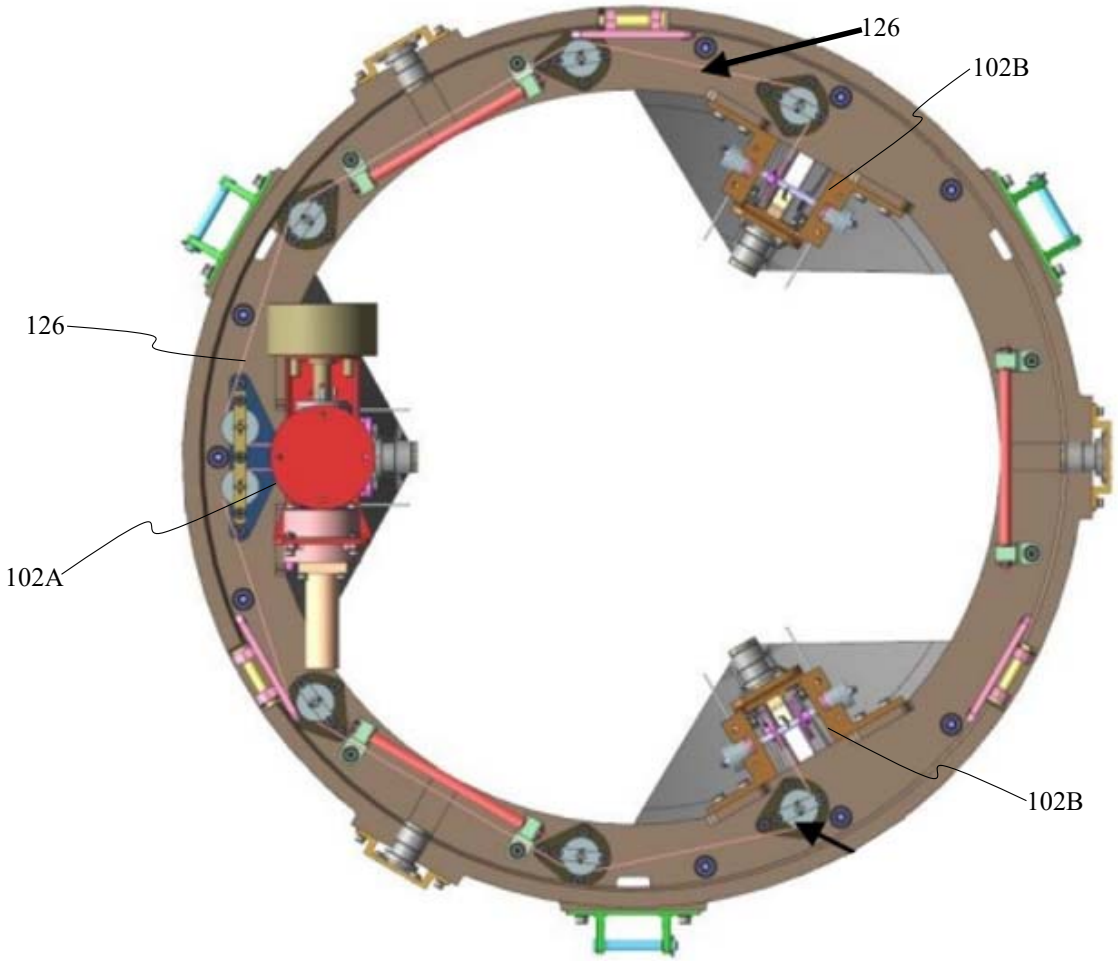

FIGURE 2(b)

Manisha Singh
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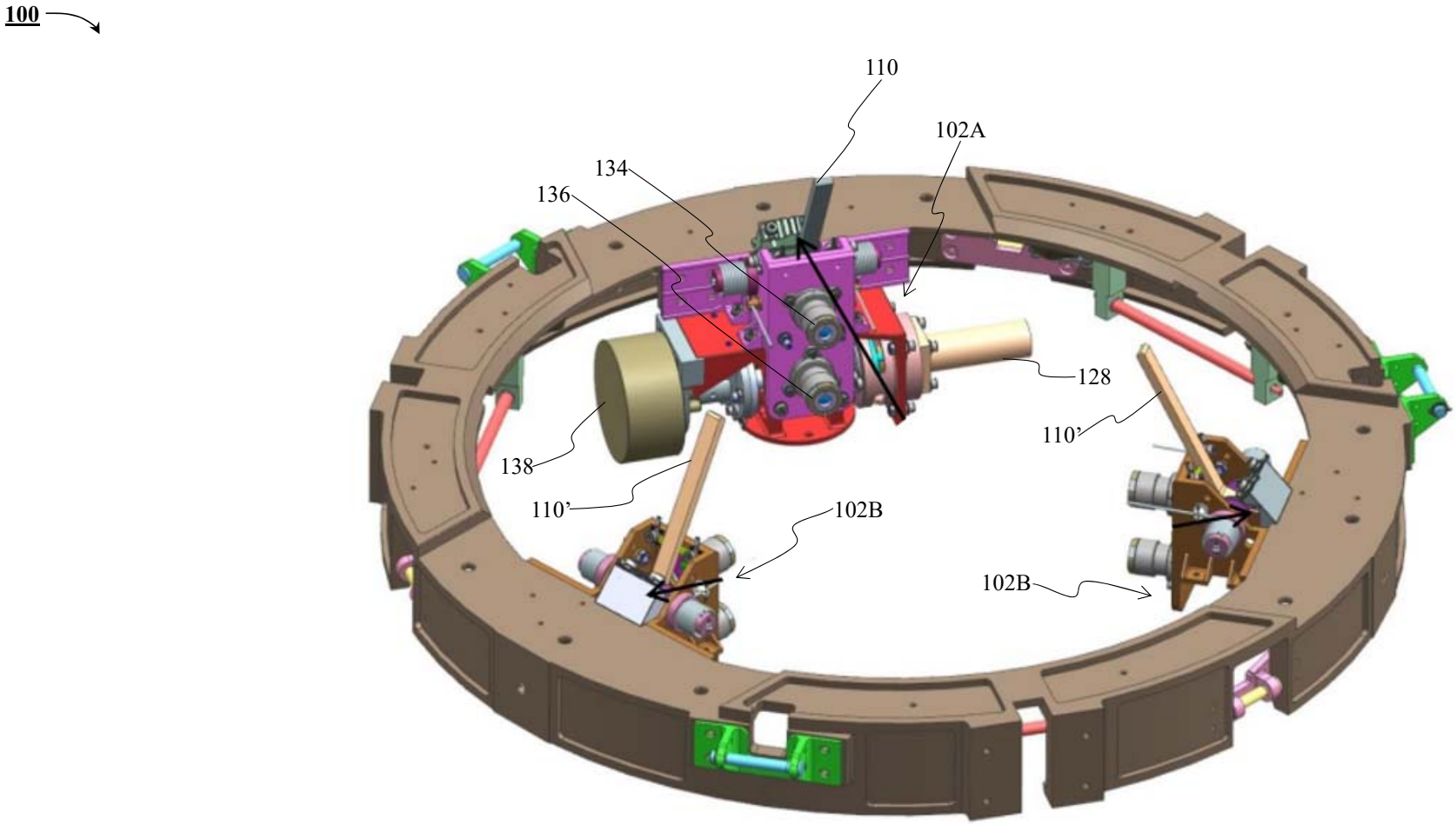

FIGURE 2(c)

Manisha Singh
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LEXORBIS

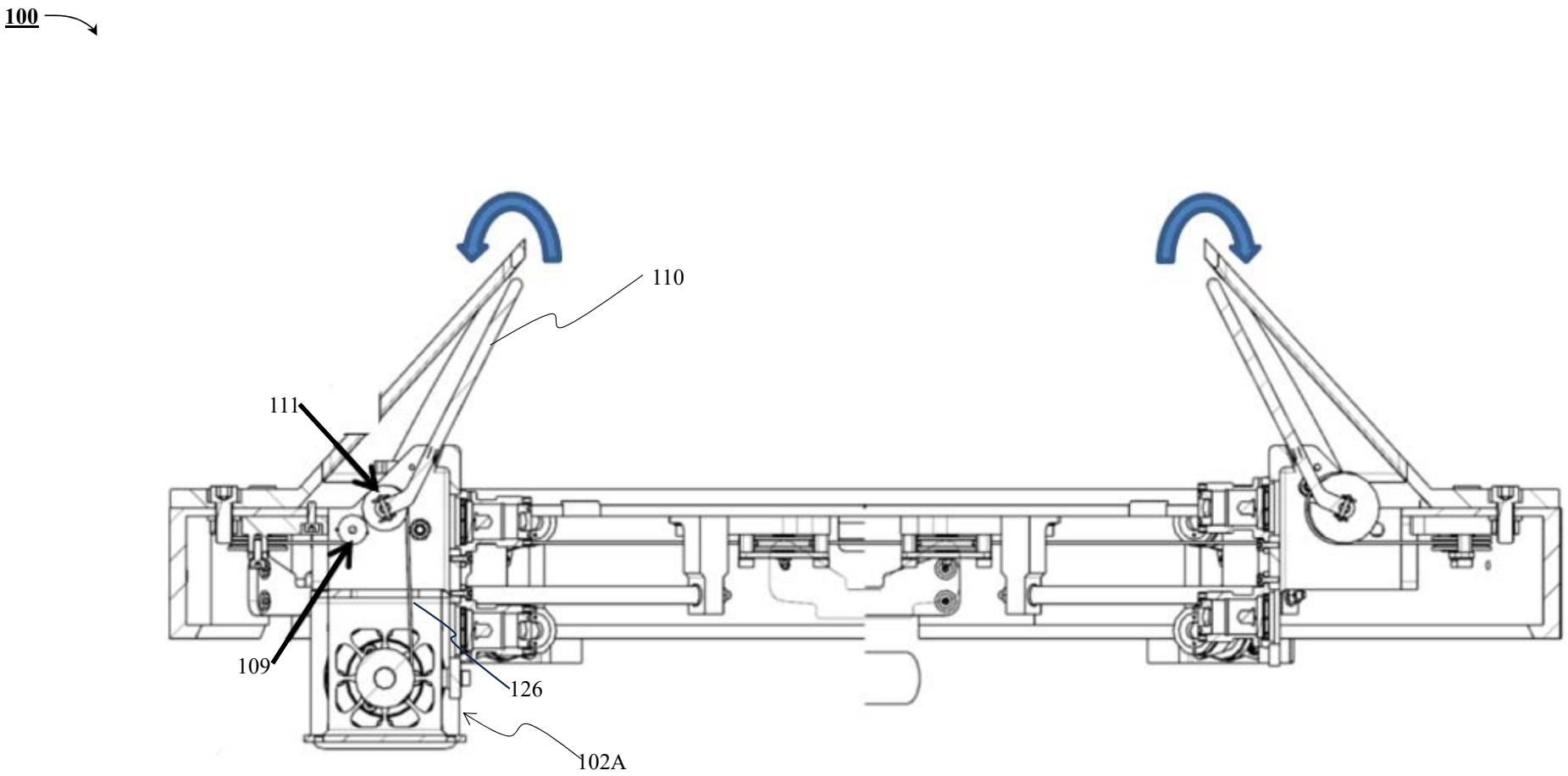

FIGURE 2(d)

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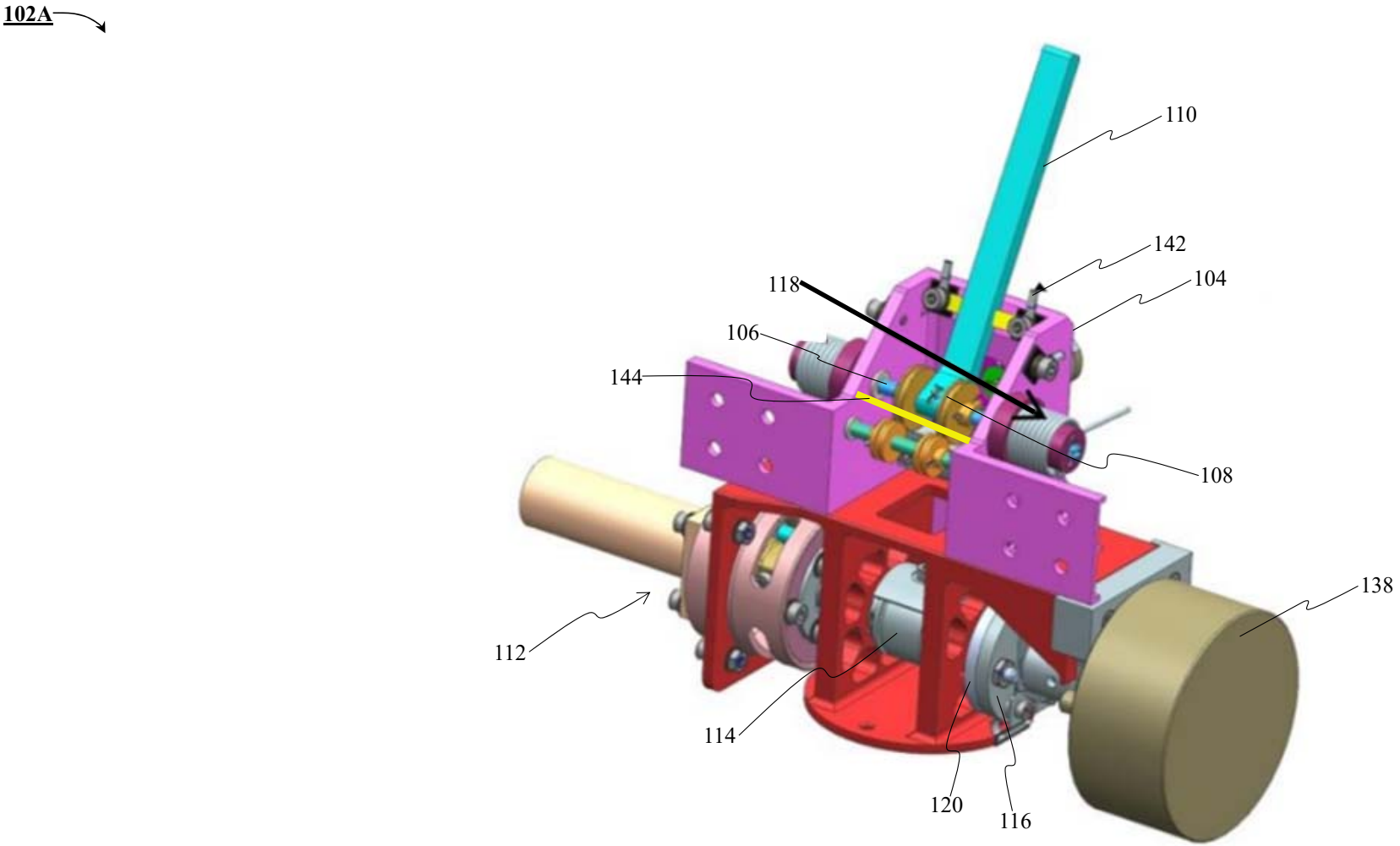

FIGURE 3

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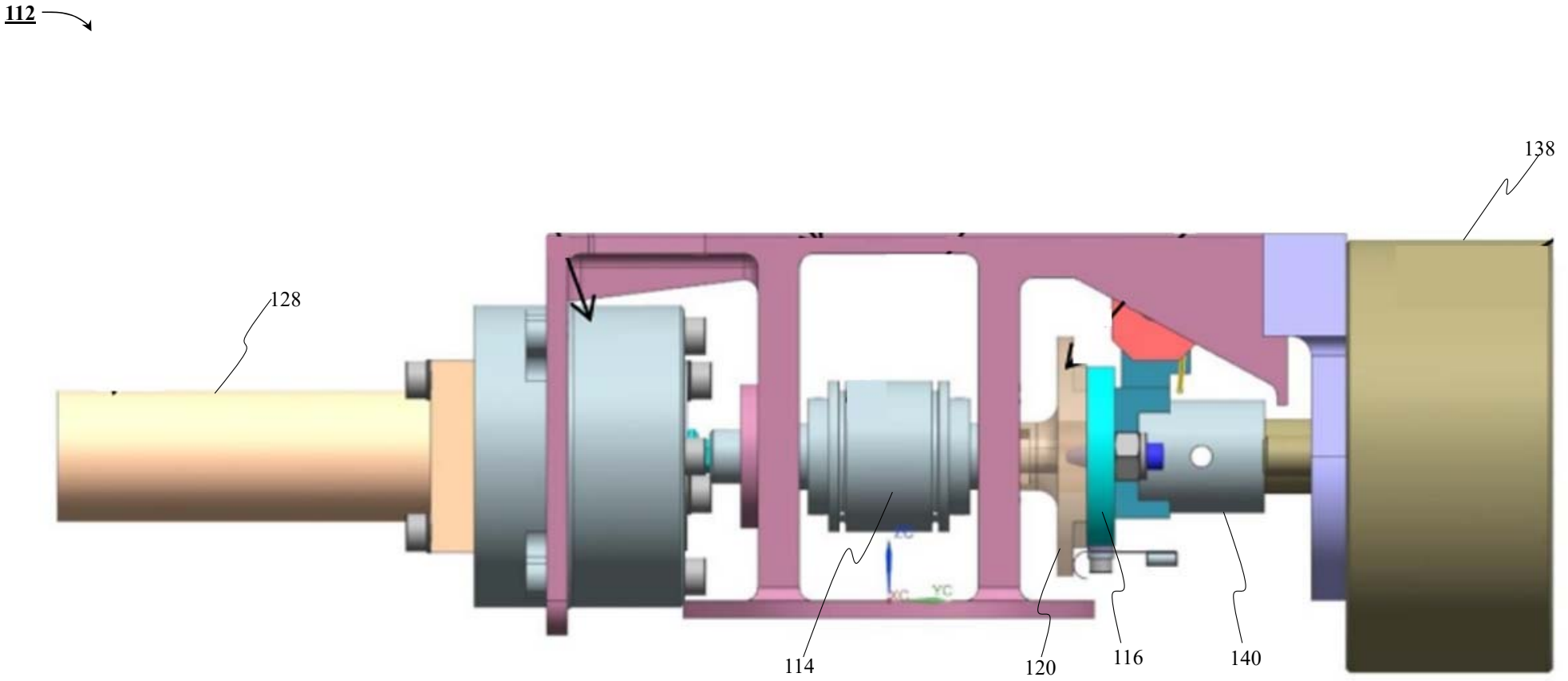

FIGURE 4(a)

Manisha Singh
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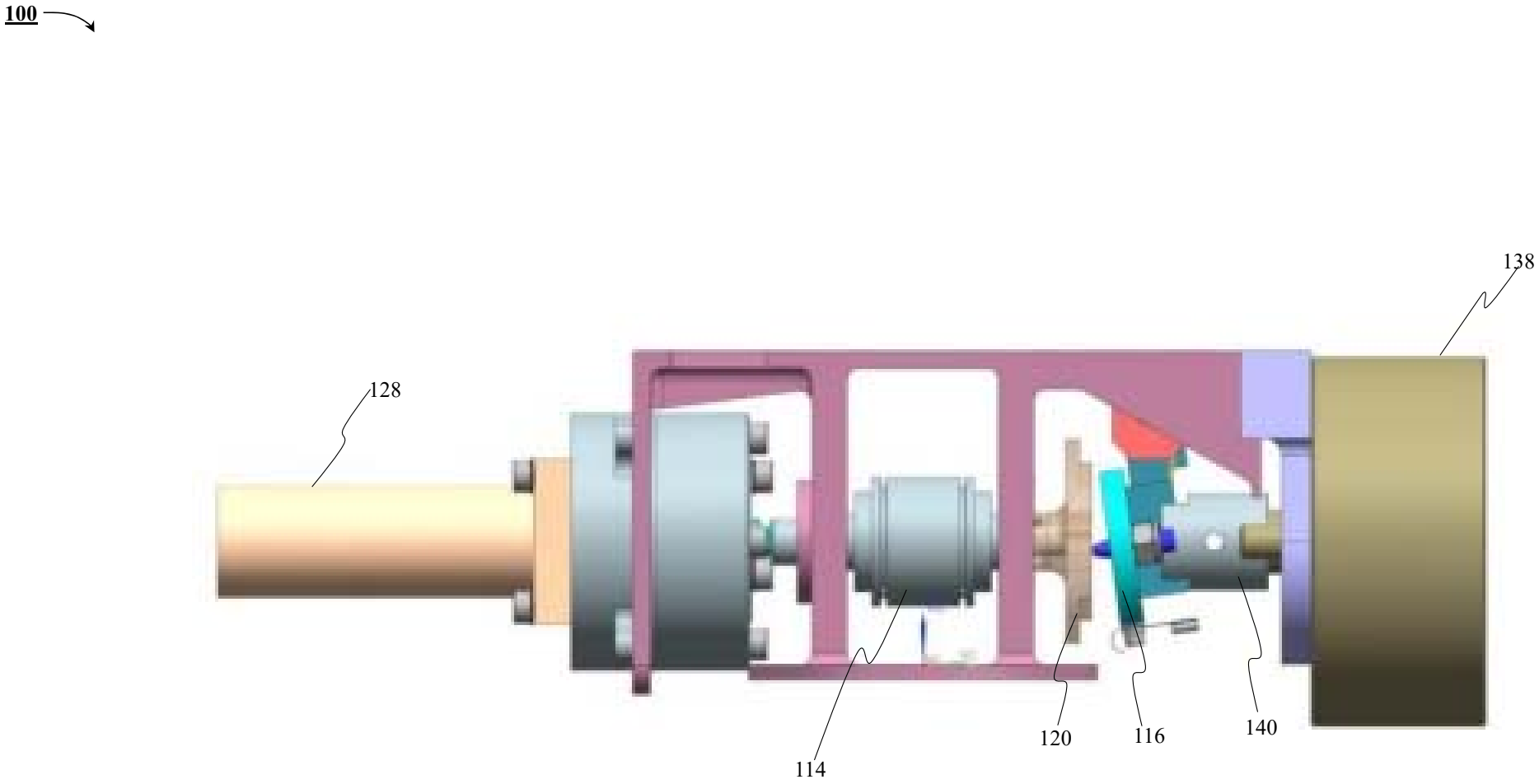

FIGURE 4(b)

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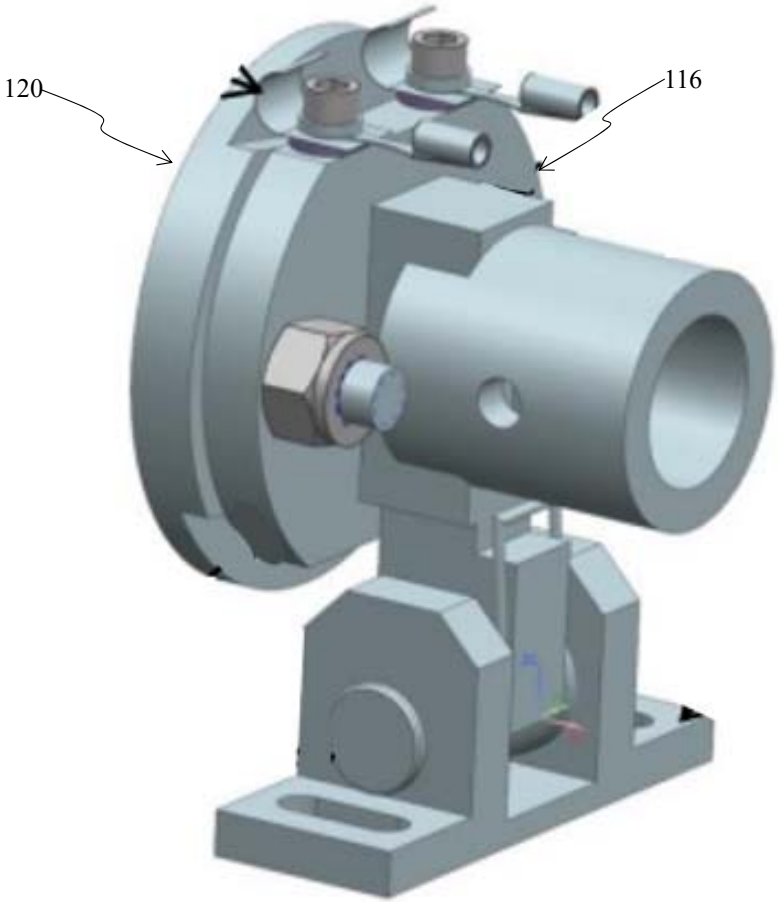

FIGURE 5(a)

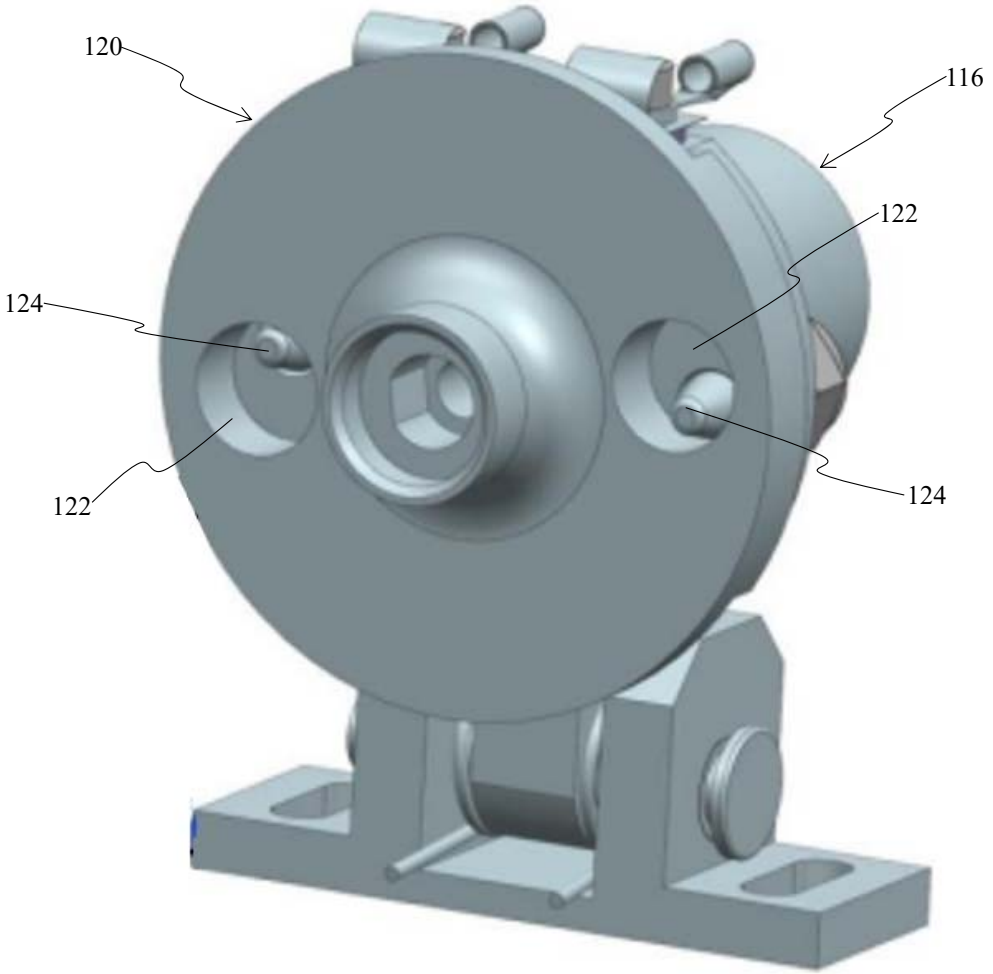

FIGURE 5(b)

Manisha Singh
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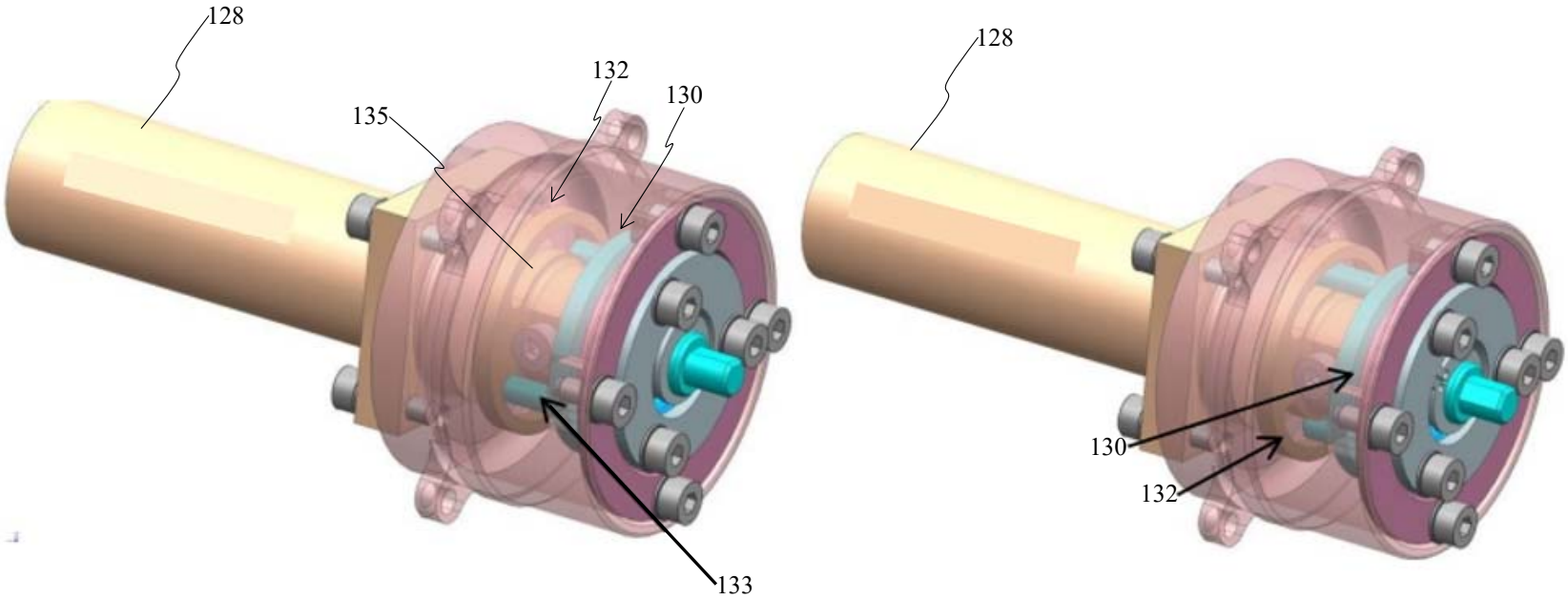

FIGURE 6

Manisha Singh
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